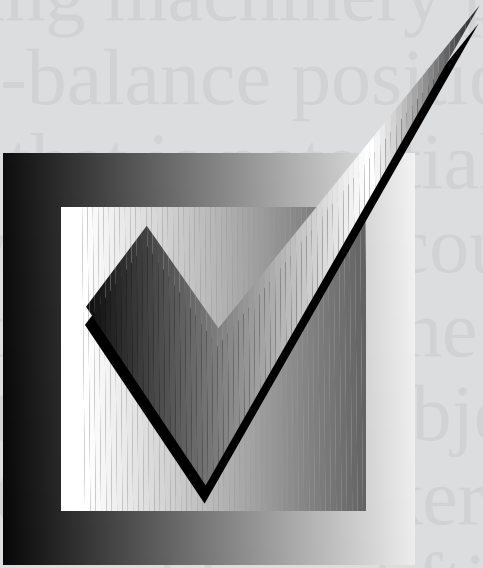
Job Hazard Analysis

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3071
1998 (Revised)



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Abstract
Job-related injuries and fatalities occur every day in the workplace. These injuries often occur because employees are not trained in the proper job procedure. One way to prevent workplace injuries is to establish proper job procedures and train all employees in safer and more efficient work methods. Establishing proper job procedures is one of the benefits of conducting a job hazard analysis carefully studying and recording each step of a job, identifying existing or potential job hazards (both safety and health), and determining the best way to perform the job or to reduce or eliminate these hazards. Improved job methods can reduce costs resulting from employee absenteeism and workers compensation, and can often lead to increased productivity. This booklet explains what a job hazard analysis is and contains guidelines for conducting your own step-by-step analysis. A sample of a completed job hazard analysis and a blank job hazard analysis form are included at the back of this booklet.

Subject Terms

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This informational booklet is intended to provide a generic, non-exhaustive overview of a particular standards-related topic. This publication does not itself alter or determine compliance responsibilities, which are set forth in OSHA standards themselves and the *Occupational Safety and Health Act*. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements, the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

This information will be made available to sensory impaired individuals upon request.

Voice phone: (202) 219-8615; Telecommunications Device for the Deaf (TDD) message referral phone: 1-800-326-2577.

Job Hazard Analysis

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1998 (Revised)

Contents

Introduction 1

Job-related injuries and fatalities occur every day in the workplace. These injuries often occur because employees are not trained in the proper job procedure.

One way to prevent workplace injuries is to establish proper job procedures and train all employees in safer and more efficient work methods. Establishing proper job procedures is one of the benefits of conducting a job hazard analysis—carefully studying and recording each step of a job, identifying existing or potential job hazards (both safety and health), and determining the best way to perform the job or to reduce or eliminate these hazards. Improved job methods can reduce costs resulting from employee absenteeism and workers' compensation, and can often lead to increased productivity.

This booklet explains what a job hazard analysis is and contains guidelines for conducting your own step-by-step analysis. A sample of a completed job hazard analysis and a blank job hazard analysis form are included at the back of this booklet.

It is important to note that the job procedures in this booklet are for illustration only and do not necessarily include all steps, hazards, or protections for similar jobs in industry. In addition, standards issued by the Occupational Safety and Health Administration (OSHA) should be referred to as part of your overall job hazard analysis. There are OSHA standards that apply to most job operations and also emphasize job hazard analysis. Compliance with OSHA standards is mandatory. Employers in any of the 25 states that operate their own OSHA-approved safety and health programs should check with their state agency, which may be enforcing standards that differ somewhat from the federal. For more information, see the "State Programs" section in the "Other Sources of OSHA Assistance" portion of this publication.

Although this booklet is designed for use by foremen and supervisors, employees also are encouraged to use the information contained in this booklet to analyze their own jobs, be aware of workplace hazards, and report any hazardous conditions to their supervisors.

For additional information on job hazard analysis and job safety and health programs, see the list of publications at the end of this booklet.

- Is the worker wearing personal protective clothing and equipment, including safety harnesses that are appropriate for the job?

A job hazard analysis can be performed for all jobs in the workplace, whether the job task is "special" (non-routine) or routine. Even one-step jobs—such as those in which only a button is pressed—can and perhaps should be analyzed by evaluating surrounding work conditions.

To determine which jobs should be analyzed first, review your job injury and illness reports. Obviously, a job hazard analysis should be conducted first for jobs with the highest rates of disabling injuries and illnesses. Also, jobs where "close calls" or "near misses" have occurred should be given priority. Analyses of new jobs and jobs where changes have been made in processes and procedures should follow. Eventually, a job hazard analysis should be conducted and made available to employees for all jobs in the workplace.

- Are work positions, machinery, pits or holes, and hazardous operations adequately guarded?

Once you have selected a job for analysis, discuss the procedure with the employee performing the job and explain its purpose. Point out that you are studying the job itself, not checking on the employee's job performance. Involve the employee in all phases of the analysis—from reviewing the job steps and procedures to discussing potential hazards and recommended solutions. You also should talk to other workers who have performed the same job.

• Are lockout procedures used for machinery deactivation during maintenance procedures?

Before actually beginning the job hazard analysis, take a look at the general conditions under which the job is performed and develop a checklist. Below are some sample questions you might ask.

- Are there materials on the floor that could trip a worker?
- Is lighting adequate?
- Are there any live electrical hazards at the jobsite?
- Are there any chemical, physical, biological, or radiation hazards associated with the job or likely to develop?
- Are tools—including hand tools, machines, and equipment—in need of repair?
- Is there excessive noise in the work area, hindering worker communication or causing hearing loss?
- Are job procedures known and are they followed or modified?
- Are emergency exits clearly marked?
- Are trucks or motorized vehicles properly equipped with brakes, overhead guards, backup signals, horns, steering gear, and identification, as necessary?
- Are all employees operating vehicles and equipment properly trained and authorized?
- Are employees wearing proper personal protective equipment for the jobs they are performing?
- Have any employees complained of headaches, breathing problems, dizziness, or strong odors?
- Is ventilation adequate, especially in confined or enclosed spaces?
- Have tests been made for oxygen deficiency and toxic fumes in confined spaces before entry?
- Are work stations and tools designed to prevent back and wrist injuries?
- Are employees trained in the event of a fire, explosion, or toxic gas release?

Naturally this list is by no means complete because each worksite has its own requirements and environmental conditions. You should add your own questions to the list. You also might take photographs of the workplace, if appropriate, for use in making a more detailed analysis of the work environment.

- Is the worker wearing clothing or jewelry that could get caught in the machinery or otherwise cause a hazard?

Nearly every job can be broken down into job tasks or steps. In the first part of the job hazard analysis, list each step of the job in order of occurrence as you watch the employee performing the job.

Be sure to record enough information to describe each job action, but do not make the breakdown too detailed. Later, go over the job steps with the employee.

Figure 1 shows a worker performing the basic job steps for grinding iron castings.

Figure 1. Grinding Castings: Job Steps

1. Reach into metal box to right of machine, grasp casting, and carry to wheel.
2. Push casting against wheel to grind off burr.
3. Place finished casting in box to left of machine.

After you have recorded the job steps, next examine each step to determine the hazards that exist or that might occur. Ask yourself these kinds of questions.

- Is the worker wearing personal protective clothing and equipment, including safety harnesses that are appropriate for the job?
- Are work positions, machinery, pits or holes, and hazardous operations adequately guarded?
- Are lockout procedures used for machinery deactivation during maintenance procedures?
- Is the worker wearing clothing or jewelry that could get caught in the machinery or otherwise cause a hazard?
- Are there fixed objects that may cause injury, such as sharp machine edges?
- Is the flow of work improperly organized (e.g., Is the worker required to make movements that are too rapid)?
- Can the worker get caught in or between machine parts?
- Can the worker be injured by reaching over moving machinery parts or materials?
- Is the worker at any time in an off-balance position?
- Is the worker positioned to the machine in a way that is potentially dangerous?
- Is the worker required to make movements that could lead to or cause hand or foot injuries, or strain from lifting—the hazards of repetitive motions?
- Can the worker be struck by an object or lean against or strike a machine part or object?
- Can the worker fall from one level to another?
- Can the worker be injured from lifting or pulling objects, or from carrying heavy objects?
- Do environmental hazards—dust, chemicals, radiation, welding rays, heat, or excessive noise—result from the performance of the job?

Repeat the job observation as often as necessary until all hazards have been identified. Figure 2 shows basic job steps for grinding iron castings and any existing or potential hazards.

Figure 2. Grinding Castings: Hazards

1. Strike hand on edge of metal box or casting; cut hand on burr. Drop casting on toes.
2. Strike hand against wheel. Flying sparks, dust, or chips. Wheel breakage. Not enough of wheel guarded. No dust removal system. Sleeves could get caught in machinery.
3. Strike hand against metal box or castings.

10 Recommending Safe Procedures and Protection

After you have listed each hazard or potential hazard and have reviewed them with the employee performing the job, determine whether the job could be performed in another way to eliminate the hazards, such as combining steps or changing the sequence, or whether safety equipment and precautions are needed to control the hazards. An alternative or additional procedure is to videotape the worker performing his or her job and analyze the job procedures.

If safer and better job steps can be used, list each new step, such as describing a new method for disposing of material. List exactly what the worker needs to know to perform the job using a new method. Do not make general statements about the procedure, such as "Be Careful." Be as specific as you can in your recommendations.

You may wish to set up a training program using the job hazard analysis to retrain your employees in the new procedures, especially if they are working with highly toxic substances or in hazardous situations. (Some OSHA standards require that formal training programs be established for employees.)

If no new procedure can be developed, determine whether any physical changes—such as redesigning equipment, changing tools, adding machine guards, personal protective equipment, or ventilation—will eliminate or reduce the danger.

If hazards are still present, try to reduce the necessity for performing the job or the frequency of performing it.

Go over the recommendations with all employees performing the job. Their ideas about the hazards and proposed recommendations may be valuable. Be sure that they understand what they are required to do and the reasons for the changes in the job procedures.

Figure 3 identifies the basic job steps for grinding iron castings and recommendations for new steps and protective measures.

Figure 3. Grinding Castings: New Procedure or Protection

1. Provide gloves and safety shoes.
2. Provide larger guard over wheel. Install local local exhaust system. Provide safety goggles. Instruct worker to wear short or tight-fitting sleeves.
3. Provide for removal of completed stock.

12 Revising the Job Hazard Analysis

A job hazard analysis can do much toward reducing accidents and injuries in the workplace, but it is only effective if it is reviewed and updated periodically. Even if no changes have been made in a job, hazards that were missed in an earlier analysis could be detected.

If an illness or injury occurs on a specific job, the job hazard analysis should be reviewed immediately to determine whether changes are needed in the job procedure. In addition, if a "close call" or "near miss" has resulted from an employee's failure to follow job procedures, this should be discussed with all employees performing the job.

Any time a job hazard analysis is revised, training in the new job methods, procedures, or protective measures should be provided to all employees affected by the changes. A job hazard analysis also can be used to train effectively new employees on the steps and job hazards.

To show how a job hazard analysis form is prepared, a sample worksheet for cleaning the inside of a chemical mix tank is given below. Both safety and health hazards are noted, as well as recommendations for safer methods and protection.

On July 17, 1990, OSHA issued a proposed rule for the management of hazards associated with processes using highly hazardous chemicals. The agency finalized this rule, called the *Process Safety Management* Standard, on February 24, 1992.

In an appendix to the proposed rule, OSHA discussed several methods of process hazard analysis. That discussion, which may be helpful for those doing job hazard analyses, follows:

What if. For relatively uncomplicated processes, review the process from raw materials to product. At each handling or processing step, "what if" questions are formulated and answered, to evaluate the effects of component failures or procedural errors on the process.

Checklist. For more complex processes, the "what if" study can be best organized through the use of a "checklist," and assigning certain aspects of the process to the committee members having the greatest experience or skill in evaluating those aspects. Operator practices and job knowledge are audited in the field, the suitability of equipment and materials of construction is studied, the chemistry of the process and the control systems are reviewed, and the operating and maintenance records are audited. Generally, a checklist evaluation of a process precedes use of the more sophisticated methods described below, unless the process has been operated safely for many years and has been subjected to periodic and thorough safety inspections and audits.

What-if/Checklist. The what-if/checklist is a broadly-based hazard assessment technique that combines the creative thinking of a selected team of specialists with the methodical focus of a prepared checklist. The result is a comprehensive hazard analysis that is extremely useful in training operating personnel on the hazards of the particular operation.

The review team is selected to represent a wide range of disciplines—production, mechanical, technical, and safety. Each person is given a basic information package regarding the

operation to be studied. This package typically includes information on hazards of materials, process technology, procedures, equipment design, instrumentation control, incident experience, and previous hazards reviews. A field tour of the operation is conducted also at this time.

The review team methodically examines the operation from receipt of raw materials to delivery of the finished product to the customer's site. At each step, the group collectively generates a listing of "what-if" questions regarding the hazards and safety of the operation. When the review team has completed listing its spontaneously generated questions, it systematically goes through a prepared checklist to stimulate additional questions.

Subsequently, the review team develops answers for each question. They then work to achieve a consensus of each question and answer. From these answers, a listing of recommendations is developed specifying the need for additional action or study. The recommendations, along with the list of questions and answers, become the key elements of the hazard assessment report.

Hazard and Operability Study (HAZOP). HAZOP is a formally structured method of systematically investigating each element of a system for all of the ways in which important parameters can deviate from the intended design conditions to create hazards and operability problems. The hazard and operability problems are typically determined by a study of the piping and instrument diagrams (or plant model) by a team of personnel who critically analyze effects of potential problems arising in each pipeline and each vessel of the operation.

Pertinent parameters are selected—for example, flow, temperature, pressure, and time. Then the effect of deviations from design conditions of each parameter is examined. A list of key words—for example, "more of," "less of," "part of"—are selected for use in describing each potential deviation.

The system is evaluated as designed and with deviations noted. All causes of failure are identified. Existing safeguards and protection are identified. An assessment is made weighing the consequences, causes, and protection requirements involved.

Failure Mode and Effect Analysis (FMEA). The FMEA is a methodical study of component failures. This review starts with a diagram of the operations, and includes all components that could fail and conceivably affect the safety of the operation. Typical examples are instrument transmitters, controllers, valves, pumps, and rotometers. These components are listed on a data tabulation sheet and individually analyzed for the following:

- Potential mode of failure (i.e., open, closed, on, off, leaks).
- Consequence of the failure; effect on other components and effects on whole system.
- Hazard class (i.e, high, moderate, low).
- Probability of failure.
- Detection methods.
- Compensating provision/remarks.

Multiple concurrent failures are also included in the analysis. The last step in the analysis is to analyze the data for each component or multiple component failure and develop a series of recommendations appropriate to risk management.

Fault Tree Analysis. A fault tree analysis can be either a qualitative or quantitative model of all the undesirable outcomes, such as a toxic gas release or explosion, which could result from a specific initiating event. It begins with a graphic representation (using logic symbols) of all possible sequences of events that could result in an incident. The resulting diagram looks like a tree with many branches listing the sequential events (failures) for different independent paths to the top or undesired event. Probabilities (using failure rate data) are

assigned to each event and then used to calculate the probability of occurrence of the undesired event.

The technique is particularly useful in evaluating the effect of alternative actions on reducing the probability of occurrence of the undesired event.

• Are there fixed objects that may cause injury, such as sharp machine edges?

Employees have the right to complain to their employers, their unions, OSHA, or another government agency about workplace safety and health hazards. Section 11(c) of the *Occupational Safety and Health (OSH) Act of 1970* makes it illegal for employees to be discriminated against for exercising this right and for participating in other job safety and health-related employee activities. These protected activities include:

- Complaining individually or with others directly to management concerning job safety conditions.
- Filing of formal complaints with government agencies, such as OSHA or state safety and health agencies, fire departments, etc. (An employee's name is kept confidential.)
- Participating in union committees or other workplace committees concerning safety and/or health matters.
- Testifying before any panel, agency, or court of law concerning job hazards.
- Participating in walk-around inspections.
- Filing complaints under Section 11(c) and giving evidence in connection with these complaints.

Employees also cannot be punished for refusing a work assignment if they have a reasonable belief that it would put them in real danger of death or serious physical injury, provided that, if possible, they have requested the employer to remove the danger and the employer has refused; and provided that the danger cannot be eliminated quickly enough through normal OSHA enforcement procedures.

If an employee is punished or discriminated against in any way for exercising his or her rights under the OSH Act, the employee must report it to OSHA within 30 days. OSHA will investigate and, if the employee has been illegally punished, OSHA will seek appropriate relief for the employee. If necessary, OSHA will go to court to protect the rights of the employee.

Safety and Health Program Management Guidelines

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. To assist employers and employees in developing effective safety and health programs, OSHA published recommended *Safety and Health Program Management Guidelines* (*Federal Register* 54(18):3908-3916, January 26, 1989). These voluntary guidelines apply to all places of employment covered by OSHA.

The guidelines identify four general elements that are critical to the development of a successful safety and health management program:

- management commitment and employee involvement,
- worksite analysis,
- hazard prevention and control, and
- safety and health training.

The guidelines recommend specific actions under each of these general elements to achieve an effective safety and health program. A single free copy of the guidelines can be obtained from the U.S. Department of Labor, OSHA Publications, P.O. Box 37535, Washington, DC 20013-7535, by sending a self-addressed mailing label with your request.

State Programs

The *Occupational Safety and Health Act of 1970* encourages states to develop and operate their own job safety and health plans. States with plans approved under section 18(b) of the OSH Act must adopt standards and enforce requirements that are at least as effective as federal requirements. There are currently 25 state plan states: 23 of these states administer plans covering both private and public (state and local government) employees; the other two states, Connecticut and New

York, cover public employees only. Plan states must adopt standards comparable to federal requirements within 6 months of a federal standard's promulgation. Until such time as a state standard is promulgated, Federal OSHA provides interim enforcement assistance, as appropriate, in these states. A listing of approved state plans appears at the end of this publication.

Consultation Services

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state government agencies or universities employing professional safety consultants and health consultants. Comprehensive assistance includes an appraisal of all work practices and environmental hazards of the workplace and all aspects of the employer's present job safety and health program.

The program is separate from OSHA's inspection efforts. No penalties are proposed or citations issued for any safety or health problems identified by the consultant. The service is confidential.

For more information concerning consultation assistance, see the list of consultation projects at the end of this publication.

Voluntary Protection Programs (VPP)

Voluntary Protection Programs (VPP) and onsite consultation services, when coupled with an effective enforcement program, expand worker protection to help meet the goals of

the OSH Act. The three VPP—Star, Merit, and Demonstration—are designed to recognize outstanding achievement by companies that have successfully incorporated comprehensive safety and health programs into their total management system. They motivate others to achieve excellent safety and health results in the same outstanding way as they establish a cooperative relationship among employers, employees, and OSHA.

For additional information on VPPs and how to apply, contact the nearest OSHA area or regional office listed at the end of this publication.

Training and Education

OSHA's area offices offer a variety of information services, such as publications, audiovisual aids, technical advice, and speakers for special engagements. The OSHA Training Institute in Des Plaines, IL, provides basic and advanced courses in safety and health for federal and state compliance officers, state consultants, federal agency personnel, and private sector employers, employees, and their representatives.

OSHA also provides funds to nonprofit organizations, through grants, to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually and grant recipients are expected to contribute 20 percent of the total grant cost.

For more information on grants, training, and education, contact the OSHA Training Institute, Office of Training and Education, 1555 Times Drive, Des Plaines, IL 60018, (847) 297-4810, (847) 297-4874 fax.

For further information on any OSHA program, contact your nearest OSHA area or regional office listed at the end of this publication.

Electronic Information

Internet—OSHA standards, interpretations, directives, and additional information are now on the World Wide Web at http://www.osha.gov/ and http://www.osha-slc.gov/.

CD-ROM—A wide variety of OSHA materials including standards, interpretations, directives, and more, can be purchased on CD-ROM from the U.S. Government Printing Office. To order, write to the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 or phone (202) 512-1800. Specify OSHA Regulations, Documents, and Technical Information on CD-ROM (ORDT), GPO Order No. S/N 729-013-00000-5. The price is $38 per year ($47.50 foreign); $15 per single copy ($18.75 foreign).

Emergencies

To report life-threatening situations, call (800) 321-OSHA. Complaints will go immediately to the nearest OSHA area or state office for help.

For further information on any OSHA program, contact your nearest OSHA area or regional office listed at the end of this publication.

Single, free copies of the following publications can be obtained from the U.S. Department of Labor, OSHA Publications, P.O. Box 37535, Washington, DC 20013-7535.

Send a self-addressed mailing label with your request.

***The Occupational Safety and Health Act of 1970,* PL-91-956 —** (OSHA 2001)

***All About OSHA* —** (OSHA 2056)

***Consultation Services for the Employer* —** (OSHA 3047)

***Control of Hazardous Energy* —** (OSHA 3120)

***How to Prepare for Workplace Emergencies* —** (OSHA 3088)

***OSHA Inspections* —** (OSHA 2098)

***OSHA Publications and Audiovisual Programs* —** (OSHA 2019)

The following publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; (202) 512-1800, (202) 512-2250 fax. Include GPO Order No. and make checks payable to the Superintendent of Documents.

Hand and Power Tools (OSHA 3080) Order No. 029-016-00143-3; Cost $1.00.

Principal Emergency Response & Preparedness Requirements in OSHA Standards and Guidance for Safety and Health Programs (OSHA 3122) Order No. 029-016-00154-9; Cost $3.75.

Training Requirements of OSHA Standards and Training Guidelines (OSHA 2254) Order No. 029-016-00160-3; Cost $6.00.

The following two publications are produced by the National Safety Council. Write to the National Safety Council, 1121 Spring Lake Drive, Itasca, IL 60143-3201.

Accident Prevention Manual

Fundamental Concepts of Industrial Hygiene

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Alaska Department of Labor
1111 West 8th Street
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Juneau, AK 99801
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Industrial Commission
of Arizona
800 W. Washington
Phoenix, AZ 85007
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California Department
of Industrial Relations
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San Francisco, CA 94105
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Connecticut Department
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Indianapolis, IN 46204
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Des Moines, IA 50319
(515) 281-3447

Secretary
Kentucky Labor Cabinet
1047 U.S. Highway,
127 South, Suite 2
Frankfort, KY 40601
(502) 564-3070

Commissioner
Maryland Division of Labor
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Licensing and Regulation
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(410) 767-2215

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Commissioner
Minnesota Department
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(505) 827-2850

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Albany, NY 12240
(518) 457-2741

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North Carolina Department
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Raleigh, NC 27603
(919) 662-4585

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Occupational Safety
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(503) 378-3272

Secretary
Puerto Rico Department
of Labor and Human
Resources
Prudencio Rivera Martinez
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505 Munoz Rivera Avenue
Hato Rey, PR 00918
(809) 754-2119

Director
South Carolina Department
of Labor Licensing
and Regulation
Koger Office Park, Kingstree
Building
110 Centerview Drive
P.O. Box 11329
Columbia, SC 29210
(803) 896-4300

Commissioner
Tennessee Department
of Labor
Attention: Robert Taylor
710 James Robertson
Parkway
Nashville, TN 37243-0659
(615) 741-2582

Commissioner
Industrial Commission
of Utah
160 East 300 South, 3rd Floor
P.O. Box 146650
Salt Lake City, UT
84114-6650
(801) 530-6898

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Vermont Department of Labor
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National Life Building -
Drawer 20
120 State Street
Montpelier, VT 05620
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*These states and territories operate their own OSHA-approved job safety and health programs (Connecticut and New York plans cover public employees only). States with approved programs must have a standard that is identical to, or at least as effective as, the federal standard.

Appendix—
Sample Job Hazard Analysis
Cleaning Inside Surface of Chemical Tank—Top Manhole Entry

STEP	HAZARD
1. Determine what is in the tank, what process is going on in the tank, and what hazards this can pose.	Explosive gas. Improper oxygen level. Chemical exposure— Gas, dust, vapor: irritant toxic Liquid: irritant toxic corrosive heated Solid: irritant corrosive Moving blades/equipment.
2. Select and train operators.	Operator with respiratory or heart problem; other physical limitation. Untrained operator—failure to perform task.
3. Set up equipment.	Hoses, cord, equipment—tripping hazards. Electrical—voltage too high, exposed conductors. Motors not locked out and tagged.

- Establish confined space entry procedures (OSHA standard 1910.146).

- Obtain work permit signed by safety, maintenance, and supervisors.
- Test air by qualified person.

- Ventilate to 19.5% -23.5% oxygen and less than 10% LEL of any flam–mable gas. Steaming inside of tank, flushing and draining, then ventilating, as previously described, may be required.

- Provide appropriate respiratory equipment— SCBA or air line respirator.

- Provide protective clothing for head, eyes, body, and feet.

- Provide harness and lifeline. (Reference: OSHA standards: 1910.106, 1910.146, 1926.100, 1926.21(b)(6); NIOSH Doc. #80-406).

- Tanks should be cleaned from outside, if possible.

- Examination by industrial physician for suitability to work.

- Train operators.
- Dry run. (Reference: National Institute for Occupational Safety and Health (NIOSH) Doc. #80-406).

- Arrange hoses, cords, lines, and equipment in orderly fashion, with room to maneuver safely.

- Use ground-fault circuit interrupter.

- Lockout and tag mixing motor, if present.

Appendix—
Sample Job Hazard Analysis
Cleaning Inside Surface of Chemical Tank—Top Manhole Entry (continued)

STEP	HAZARD
4. Install ladder in tank.	Ladder slipping.
5. Prepare to enter tank.	Gas or liquid in tank.
6. Place equipment at tank-entry position.	Trip or fall.
7. Enter tank.	Ladder—tripping hazard. Exposure to hazardous atmosphere.
8. Cleaning tank.	Reaction to chemicals, causing mist or expulsion of air contaminant.
9. Cleaning up.	Handling of equipment, causing injury.

- Secure to manhole top or rigid structure.

- Empty tank through existing piping.
- Review emergency procedures.
- Open tank.
- Check of jobsite by industrial hygienist or safety professional.
- Install blanks in flanges in piping to tank (isolate tank).
- Test atmosphere in tank by qualified person (long probe).

- Use mechanical-handling equipment.
- Provide guardrails around work positions at tank top.

- Provide personal protective equipment for conditions found. (Reference: NIOSH Doc. #80-406; OSHA CFR 1910.134).

- Provide outside helper to watch, instruct, and guide operator entering tank, with capability to lift operator from tank in emergency.

- Provide protective clothing and equipment for all operators and helpers.
- Provide lighting for tank (Class I, Div. 1).
- Provide exhaust ventilation.
- Provide air supply to interior of tank.
- Frequent monitoring of air in tank.
- Replace operator or provide rest periods.
- Provide means of communication to get help, if needed.
- Provide tow-man standby for any emergency.

- Dry run.
- Use material-handling equipment.

Job Hazard Analysis Form

JOB TITLE: _____

DATE OF ANALYSIS: _____

JOB LOCATION: _____

STEP	HAZARD

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